

The Model 460 is a reel-to-reel recorder designed to record the outputs of several hydrophone devices while submerged in an oceanographic vehicle. Utilizing modular mechanical and electrical components, the Model 460 is packaged to fit in a 5 inch cylinder. The recorder measures 5" x 5" x 10", weighs 5 pounds and operates from only 5 watts of power.

MODEL 460

UNDERWATER SOUND TAPE RECORDER

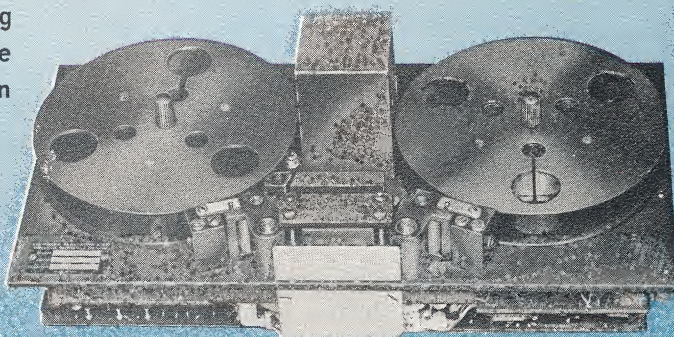
The Model 460 is capable of recording up to 7 tracks of information whose frequency ranges from 10 to 5000 cps. The recorder can be remotely operated at two speeds. Tape capacity of 750 feet provides operation for 30 minutes in the descend mode, 30 minutes in the hover mode and 67 minutes in the ascend mode.

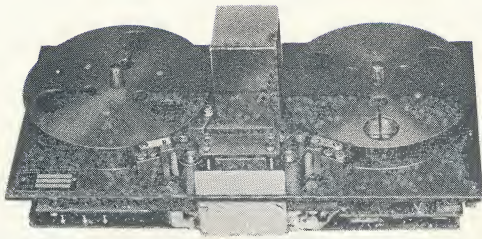
COMPACT

RELIABLE

Primary design importance was attached to the reduction of air-transmitted and directly-transmitted acoustical noise. Designs and components were selected for minimum contribution to the generation of acoustical noise; damping and isolation were used wherever possible. Although final data reduction was to be accomplished on external IRIG-compatible equipment, a preliminary or "confidence" check was provided during rewind, by the use of integral reproduce heads to detect the presence of data on the tape.

**LOW POWER
CONSUMPTION**





SPECIFICATIONS

OPERATIONAL

The Model 460 is typical of the special purpose recorders available with the use of modular recorder components.

Should you require low weight, low power compact recorders for under-sea, shipboard, airborne or space applications, contact Lockheed for prompt reliable information.

- Tape Width 0.5''
- Number of Tracks 7
- Tape Capacity 750 feet
- Frequency Response 10-5000 cps
- Input Level 0.5V RMS
- Input Impedance 10,000 ohms
- Harmonic Distortion Less than 0.9% third harmonic
- Flutter Less than 1% p-p to 500 cps
- Power Consumption Less than 5W
- Tape Speeds
Ascend 15/16 ips
Hover 1-7/8 ips
Rewind 7½ ips
- Recording Time 160 minutes @ 15/16 ips

MECHANICAL

- Size 5'' x 5'' x 10''
- Weight 5 pounds

ENVIRONMENT

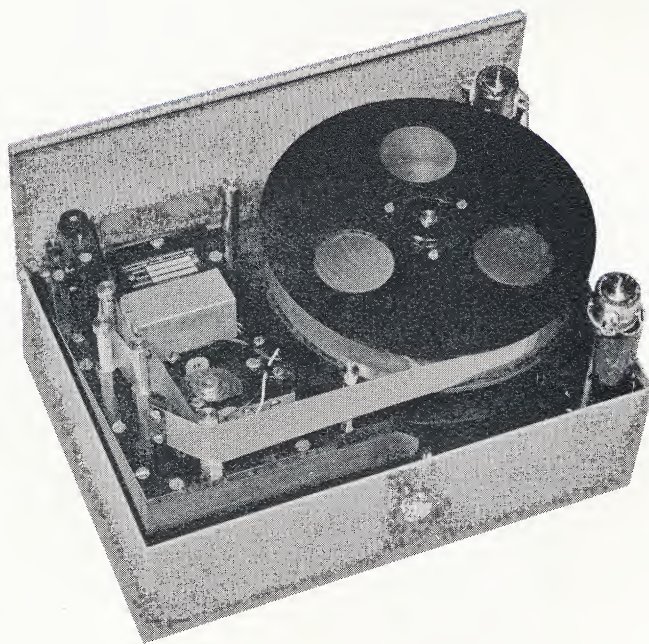
- Temperature 28 to 105°F operating
-50 to 150°F storage
- Relative Humidity To 99% without condensation
- Shock & Vibration Withstands shipboard handling and sea impact

Specifications are subject to change without notice.

LOW POWER
0.9 WATTS

COMPACT
 $8 \frac{5}{8}'' \times 6'' \times 6 \frac{3}{4}''$

LONG RECORD TIME
20 HOURS



MODEL 463

BALLOON FLIGHT TAPE RECORDER



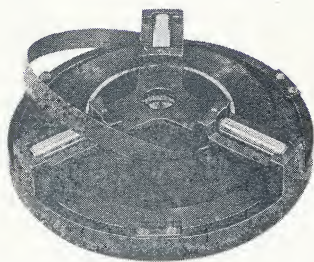
The Model 463 although specifically designed for use in balloon borne vehicles studying upper atmosphere environments, is also ideally suited to those applications requiring long recording times with a minimum of power consumption. Utilizing coaxial reels, modular bearing assemblies, sophisticated phase-lock servo system and special low-power motor drive, the Model 463 can record 16 tracks of digital data for 20 hours while consuming a total of only 18 watt-hours of power.

The Model 463 is typical of the special purpose recorders available with the use of modular recorder components.

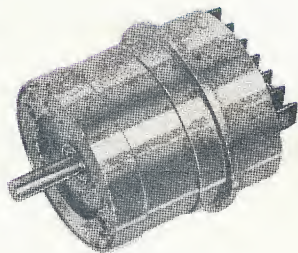
Should you require low weight, low power compact recorders for undersea, shipboard, airborne or space applications, contact Lockheed for prompt reliable information.

TYPICAL MODULES

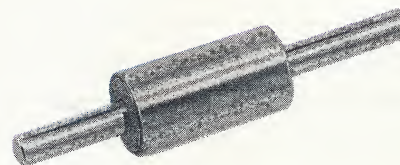
FOR SPECIAL PURPOSE RECORDERS



CARTRIDGE



MOTOR



BEARING

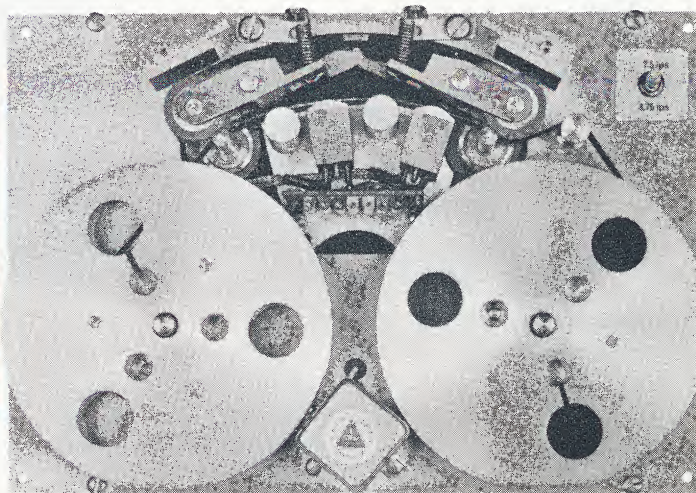
SPECIFICATIONS

Tape Width	0.75 in.
Tape Length	1000 ft.
Tape Speed	0.16 ips
Record Time	20 hours
Power Consumption	0.9 watts
Operating Voltage	12 V
Weight	4 pounds
Number of Tracks	16
Track Width	0.025"
Track Spacing	0.047" center/center
Gap Scatter	$\pm 0.00005''$
Record Current	2 to 4 ma

MODEL 461

MINIATURE TAPE RECORDER/REPRODUCER

LOW POWER VEHICULAR
RECORDER DESIGNED
FROM PRETESTED STAND-
ARDIZED MODULAR MECH-
ANICAL COMPONENTS.



**ACOUSTICALLY
QUIET**

**I.R.I.G.
COMPATIBLE**

**COMPACT
LOW POWER**

**PRECISION
TRANSPORT**

The Model 461 tape recorder is designed to minimize airborne and directly-transmitted acoustical noise during operation. Every precaution was taken to choose techniques and mechanical components which make a minimum contribution to the generation of acoustical noise. This recorder was designed for field use and provides the capability of recording up to 7 tracks, either FM or Direct with bandwidths to 2500 and 25000 cps respectively. The recording format is in accordance with I.R.I.G. document 106-60, track geometry for 1/2" tape.

The Model 461 weighs 6 pounds, 9 ounces including 750 feet of tape. The total transport volume is 230 cubic inches and power consumption, including separately-packaged electronics is less than 4 watts.

Utilizing a unique miniature low mass differential capstan drive and a phase lock servo system, the recorder provides precision data for reproduction on standard laboratory equipment.

SPECIFICATIONS

OPERATIONAL

- **Tape Widths:** One-half inch.
- **Tracks:**
- **Spacing:** In accordance with IRIG document 106-60.
- **Channels:** 7 FM or direct record.
- **Frequency Response:** FM $7\frac{1}{2}$ ips; 0 to 2.5 kc ± 0.5 db. $3\frac{3}{4}$ ips; 0 to 1.25 kc ± 0.5 db.
- **Signal-To-Noise Ratio:** FM, 41 db (rms/rms over specified pass band).
- **Frequency Response Direct:** $7\frac{1}{2}$ ips; 200 cps to 24 kc. $3\frac{3}{4}$ ips; 200 cps to 12 kc.
- **Signal-to-Noise (direct):** 41 db rms/rms (over specified pass band) referenced to 1,000 cps signal recorded to 1.5% total harmonic distortion (as reproduced on Lockheed Model 417B recorder or equivalent.)
- **Input Level:** 100 millivolts to 2 volts.
- **Harmonic Distortion:** 1.5% for 1 kc signal.
- **Flutter:** 0.75% peak-to-peak (measured from 0 to 5 kc at $7\frac{1}{2}$ ips)
- **Input Impedance:** 20k minimum.
- **Control Logic:** OFF (STOP), RECORD, STANDBY
- **Tape Speeds:** $7\frac{1}{2}$ ips and $3\frac{3}{4}$ ips.
- **Record Time:** 20 minutes at $7\frac{1}{2}$ ips, 40 minutes at $3\frac{3}{4}$ ips.
- **Power Requirements:** 3.84 watts (240 milliamps at 16 volts dc).
- **Speed Stability:** $\pm 0.1\%$ at 70°F. $\pm 0.2\%$ over the specified operating temperature range.

MECHANICAL

- **Size:** $9\frac{3}{4}$ by $6\frac{3}{4}$ by $3\frac{1}{2}$ inches.
- **Weight (With Tape):** 6 pounds 9 ounces.

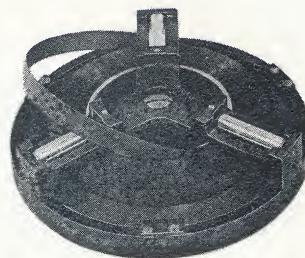
ENVIRONMENTAL

- **Relative Humidity:** 95% without condensation.
- **Temperature:** +20°F to 140°F Operating Temperature Range.
- **Storage:** 50°F to +150°F.
- **Shock and Vibration:** $\frac{1}{2}$ g, 1 cps to 300 cps with flutter not exceeding 1%.
- **Operating Position:** Any position.

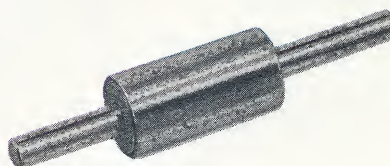
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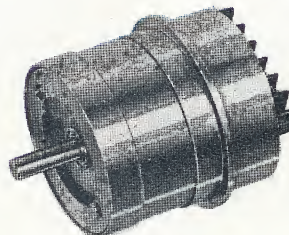
TYPICAL MODULES



CARTRIDGE

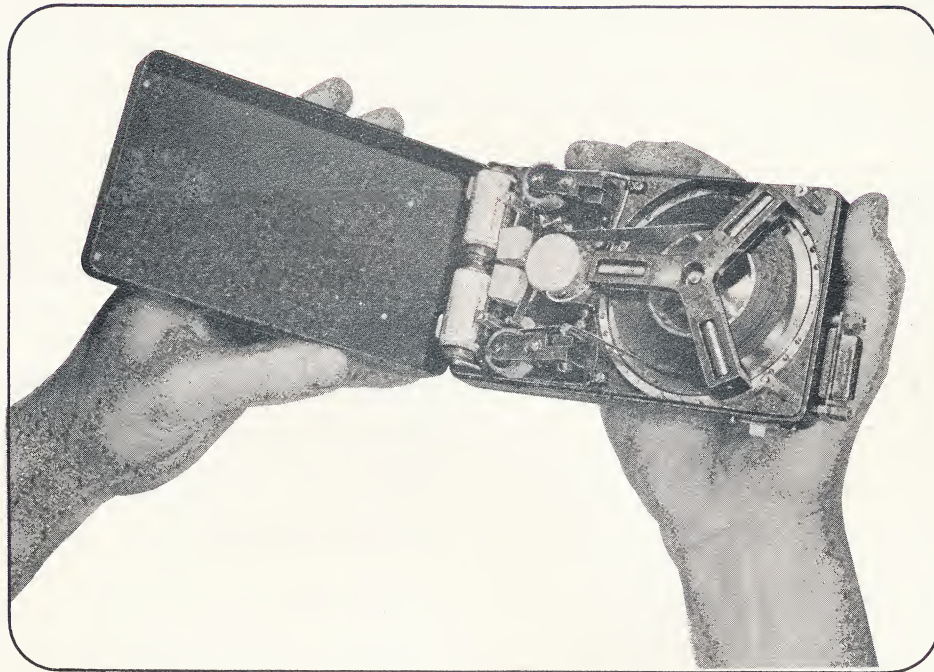


BEARING



MOTOR

MODEL 958



MINIATURE MEDICAL RECORDER

This miniature, self-contained, 7-channel tape recorder is used to record physiological measurements from a freely moving body. The D. C. to 100 cycle analog data is FM recorded at 0.5 in/sec. on 1/4" tape over a 2 hour recording period.

The playback system is a modified LEC Model 417 recorder/reproducer.

MODEL 958

SPECIFICATIONS

MECHANICAL

- Size 6 x 3-1/2 x 1-11/16 inches excluding connector
- Weight 20 ounces

OPERATIONAL

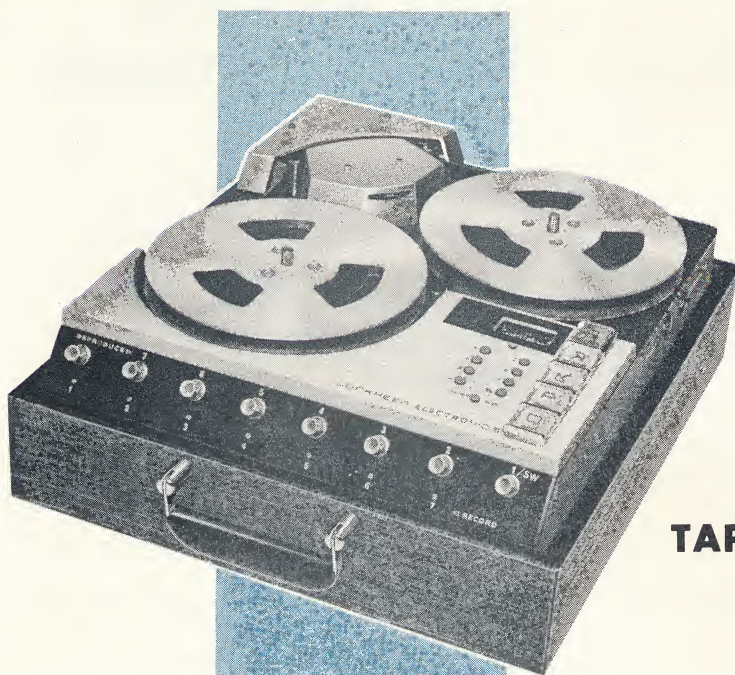
- Batteries Multiple cell type S76 contained in recorder
- Recording Tracks Seven data, one reference
- Frequency Response D.C. to 100 cps (6 Db down at 100 cps)
- Signal/Noise Limited by Playback equipment
- Input Signal Level $\pm .5$ volts for $\pm 40\%$ deviation
- Input Impedance 50 K ohms minimum
- Power Consumption .5 watts max.
- Continuous Recording Time 1.3 hours
- Operating Time w/one set of batteries 2.5 hours
- Record Format FM with a center frequency of 860 ± 20 cps
- Tape Speed .5 inches/second
- Tape Width 1/4 inch
- Tape Drive System D.C. Motor, Dual capstan drive
- Tape Handling Method Endless Loop Cartridge w/200 ft. tape
- Clock Track Tuning Fork reference frequency recorded on track eight

ENVIRONMENTAL

- Operating Temperature Range $+40^{\circ}\text{F}$ to 100°F

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.





MODEL 417D

INSTRUMENTATION TAPE RECORDER/REPRODUCER

7-TRACK

PORTABLE

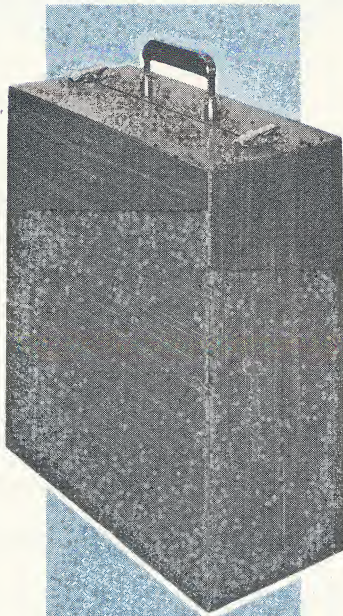
RUGGED

27 POUNDS

BATTERY-POWERED

The unique Model 417D utilizes a low-mass differential capstan drive to assure precision instrumentation recording even under difficult operating conditions.

A really portable instrumentation tape recorder/reproducer, the Model 417D provides full 7-track IRIG compatibility. Either battery or AC/DC powered, this light-weight rugged recorder makes it possible to avoid the high cost and risks of shipping equipment to test sites. Its compact, "attache case" size allows it to be carried under the seat of commercial aircraft. Recording at remote or inaccessible locations without the need for external power and attendant ground-loop problems makes the Model 417D an ideal complement to conventional rack-mounted equipment.



THE 417D PROVIDES QUALITY FEATURES HERETOFORE AVAILABLE ONLY ON THE MOST SOPHISTICATED AND COSTLY FIXED INSTALLATION RECORDERS.

**DIFFERENTIAL CAPSTAN DRIVE
PHASE-LOCK SERVO MOTOR CONTROL
DYNAMIC BRAKING**

QUALITY CONSTRUCTION

- All solid-state circuitry.
- Convenient plug-in modules.
- High efficiency "spacecraft"-type DC motors.
- Differential capstans provide constant, controlled tape-to-head contact.
- Phase-lock servo motor control to ensure accurate tape speed.
- Precision-shielded duplex pre-loaded (gyro-type) ball bearings.
- Gentle tape handling due to dynamic braking system.
- Safety interlocks to prevent accidental signal loss.
- Reel-motor control system integrated with servo for maximum efficiency.

CONSIDER THESE FEATURES

FUNCTIONAL FEATURES

- Built-in, long life, maintenance-free, rechargeable nickel-cadmium batteries.
- No external power source required.
- Operation on 28V DC or 110V AC external power with the Model 1031 Auxiliary Power Supply and Battery Charger (optional).
- Record level meter.
- Pushbutton Control.
- Rewind/Fast Forward.
- Remote Control (optional).
- Environmental Case (optional).
- Standard BNC-type connectors.
- Battery "state-of-charge" indicator.
- Voice Track (optional).
- Footage Counter (optional).
- Endless - Loop Adapter (optional).

PORTABILITY

- Total weight, only 27 lbs.
- Operates in any attitude.
- Compact "attache case" size 13-15/16" x 15-3/16" x 6-3/8".
- Maximum power consumption only 12 watts.

PRECISION PERFORMANCE

- Flutter less than .2% RMS.
- Frequency response - 100kc direct / 10kc FM.
- 7 tracks, FM or Direct in any combination, on 1/2" tape with IRIG record or reproduce capability (4 tracks on 1/4" tape also available).
- Switchable reproduce track for field monitoring.

Specifications are subject to change without notice.

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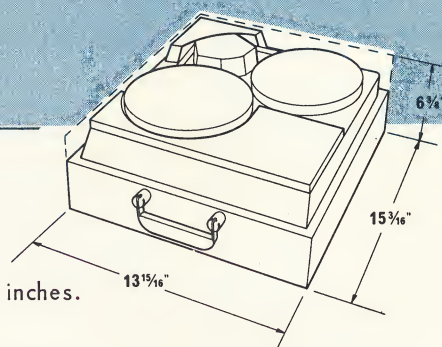
MODEL 417D INSTRUMENTATION TAPE RECORDER/REPRODUCER

LOCKHEED

SPECIFICATIONS



GENERAL CHARACTERISTICS



SIZE: 13-15/16 x 15-3/16 x 6-3/8 inches.

WEIGHT: 27 pounds.

TAPE SPEEDS: Choice of 2 speed combinations 1 7/8, 3 3/4, 7 1/2 or 7 1/2, 15, 30ips. (Speed change kit optional.)

TAPE DIMENSIONS: 1/4 - or 1/2 - inch tape. Accepts 0.75, 1.0 or 1.5 mil base tape. 7- inch diameter reels. Cover closes with reels in place.

CONTROLS: Pushbutton operation for OFF, RECORD, REPRODUCE, REWIND, FAST FORWARD. Electronic modules may be intermixed to provide any combination of Direct and FM record or reproduce channels. Recorder provides either 7-track record with switchable reproduce, or 7-track reproduce. Up to 4 tracks of simultaneous record-reproduce (7 tracks optional). Meter provided for direct-record level adjustment and battery "state-of-charge" monitoring.

START TIME: 5 seconds or less at all tape speeds from STOP to stable speed.

STOP TIME: 5 seconds or less.

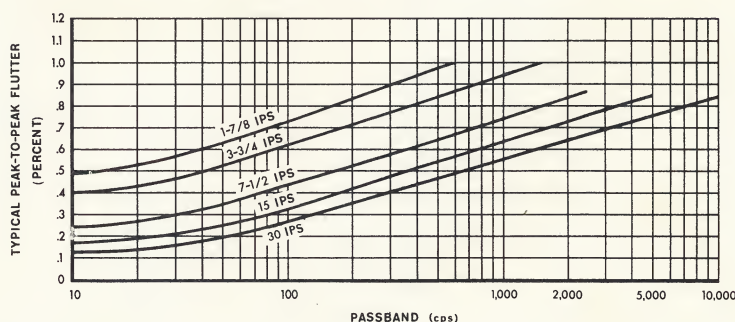
REWIND AND FORWARD TIME: 5 minutes for 1,800 feet of tape.

TAPE RUNNING TIME:	TAPE SPEED (ips)	3150 feet 0.65 mil	1800 feet 1.0 mil	1200 feet 1.5 mil
	1-7/8	6 hours	3 hours	2 hours
	3-3/4	3 hours	90 min.	1 hour
	7-1/2	90 min.	45 min.	30 min.
	15	45 min.	22 min.	15 min.
	30	22 min.	11 min.	7 min.

INTERNAL POWER CONSUMPTION: Less than 750ma @ 17 volts, with transport and all electronics operating at 30 ips. Internal Ni-Cd battery provides 1.5 hours operation on one charge (larger battery optional). Automatic low-voltage cutoff.

BATTERY CHARGING: Charging time 14 hours at 120 ma (20 volts dc). BACPAC Battery Charger and Auxiliary Power Supply (Catalog No. 1020) available as optional equipment. Permits Recorder operation from 115/220 volts 50 to 400 cps. Also charges battery.

MAXIMUM CUMULATIVE FLUTTER:



ENVIRONMENTAL

TEMPERATURE: 32° to 120° F operating.
-20° to 160° F non-operating.

HUMIDITY: To 99% without condensation.

DIRECT RECORD/REPRODUCE SYSTEM

FREQUENCY RESPONSE:	TAPE SPEED (ips)	FREQUENCY RESPONSE (± 3 db)	SIGNAL-to-NOISE*
	30	200 to 100,000 cps	34 db
	15	100 to 50,000 cps	34 db
	7-1/2	100 to 25,000 cps	34 db
	3-3/4	100 to 12,500 cps	34 db
	1-7/8	100 to 6,250 cps	34 db

* rms signal to rms noise — 1000 cps signal recorded to 1.5% total harmonic distortion.

SIGNAL-TO-NOISE RATIO: Nominal signal level for 1.5% total harmonic distortion (1,000 cps fundamental).
Noise measurements include circuit and media noise. Measurements made with 18 db/octave attenuation bandpass filter at output of reproduce amplifier.

INPUT LEVEL: 100 mv to 10 volts rms.

OUTPUT LEVEL: 1.0 volts rms (nominal across a 10,000-ohm load at normal recording level).

INPUT IMPEDANCE: 20,000 ohms minimum.

OUTPUT IMPEDANCE: 100 ohms maximum.

HARMONIC DISTORTION: 1.5% (measured at 1,000 cps).

CROSSTALK: -42 db (below nominal signal level at 1 kc).

FM RECORD/REPRODUCE SYSTEM

SIGNAL CHARACTERISTICS:	TAPE SPEED (ips)	CENTER FREQUENCY (cps)	FREQUENCY RESPONSE ($\pm 1/2$ db)	SIGNAL-to-NOISE*
	30	54,000	0 to 10,000	40 db
	15	27,000	0 to 5000	40 db
	7-1/2	13,500	0 to 2500	40 db
	3-3/4	6,750	0 to 1250	37 db
	1-7/8	3,375	0 to 625	37 db

*rms signal to rms noise.

INPUT LEVEL: ± 1.4 volts for full deviation ($\pm 40\%$).

OUTPUT LEVEL: 1.0 volt rms.

HARMONIC DISTORTION: 1.5%

INPUT IMPEDANCE: 20,000 ohms minimum.

OUTPUT IMPEDANCE: 1,000 ohms maximum.

AC/DC LINEARITY: Better than 1% of full scale.

DRIFT: Less than 0.3% after 5 minute warm-up.

TEMPERATURE STABILITY: 0.4% per 10°F from 32° to 120°F after 5-minute warm-up.

SERVO SYSTEM

DESCRIPTION: Multiple-loop servo containing a coarse velocity-sensitive loop and a fine, high-resolution locked-phase servo. System integrated with supply and takeup reel motor control to provide overall maximum efficiency.

SPEED ACCURACY: $\pm 0.25\%$ at 70°F.

SERVO DRIFT: $\pm 1.0\%$ over operating temperature range. Special oscillator available to provide 0.1%.

MAGNETIC HEADS

NUMBER OF TRACKS: IRIG-compatible 7-track record/reproduce.

TRACK WIDTH: 0.050 inch.

TRACK SPACING: 0.070 inch center to center.

GAP WIDTH: Record head 0.0005 inch.
Reproduce head 0.0001 inch.
(Voice edge track optional)

4-track record/reproduce.

0.043 inch.

0.068 inch center to center.

Record head 0.0005 inch.
Reproduce head 0.0001 inch.

Specifications are subject to change without notice.

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